Flowsic100 Flare

A practical guide to flowsic100 flare, covering the reader intent, the relationship to flowsic100 flare, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.

levelmeter.org
Main topic: Main Page
https://www.level-meters.com/

In the demanding environments of oil refineries, chemical processing plants, and upstream oil and gas facilities, flare gas measurement represents one of the most significant technical challenges. The Flowsic100 Flare is a specialized ultrasonic flow measurement system designed specifically to address the extreme dynamics of flare gas applications. Unlike standard gas flow meters, flare gas meters must operate accurately across a massive velocity range—from nearly stagnant conditions during normal operation to supersonic speeds during emergency blowdown events.

Accurate measurement of flare gas is not merely a process requirement; it is a regulatory necessity. Environmental agencies worldwide require precise reporting of flared volumes to monitor greenhouse gas emissions. This guide examines the engineering principles, selection criteria, and installation requirements for the Flowsic100 Flare, providing a technical foundation for engineers managing emission monitoring and process safety systems.

Understanding Ultrasonic Transit-Time Measurement

The Flowsic100 Flare operates on the ultrasonic transit-time difference principle. This method is non-intrusive and offers no resistance to flow, which is critical in flare headers where any pressure drop or obstruction could compromise safety during a relief event.

The Measurement Principle

The system utilizes pairs of ultrasonic transducers mounted opposite each other on the flare pipe. These transducers act as both transmitters and receivers. The fundamental principle relies on the fact that sound waves traveling in the direction of the gas flow move faster than sound waves traveling against the flow.

1. Downstream Signal: A sound pulse is sent from the upstream transducer to the downstream transducer.

2. Upstream Signal: A sound pulse is sent from the downstream transducer to the upstream transducer.

3. Time Difference: The electronics unit calculates the difference in time (dt) between these two signals.

Because the speed of sound in the gas is affected by temperature, pressure, and gas composition (molecular weight), the transit-time method is particularly robust. By measuring the time in both directions, the system can calculate the gas velocity independently of the speed of sound, effectively canceling out the variables of gas composition and temperature in the primary velocity calculation.

Performance in Extreme Conditions

Flare gases often contain a mixture of hydrocarbons, hydrogen, nitrogen, and carbon dioxide. The molecular weight can fluctuate rapidly. The Flowsic100 Flare is engineered to maintain signal integrity even when the gas composition changes or when high levels of CO2 or H2S are present, which are known to attenuate ultrasonic signals. High-power transducers are often employed to ensure the signal can bridge the pipe diameter even during high-turbulence events.

Technical Specifications and Selection Criteria

Selecting the correct version of the Flowsic100 Flare depends on the pipe diameter, the required measurement range, and the environmental conditions of the installation site. The system is typically categorized into different versions based on transducer size and power.

Selection Table: Flowsic100 Flare Versions

Feature	Flowsic100 Flare-S	Flowsic100 Flare-M	Flowsic100 Flare-L
Pipe Diameter Range	100 mm to 400 mm	400 mm to 1000 mm	Up to 3000 mm+
Max Gas Velocity	Up to 120 m/s	Up to 120 m/s	Up to 120 m/s
Min Gas Velocity	0.03 m/s	0.03 m/s	0.03 m/s
Transducer Material	Titanium / Hastelloy	Titanium / Hastelloy	Titanium / Hastelloy
Cooling/Purging	Optional	Optional	Optional
Redundancy	Single-path	Single or Dual-path	Multi-path available

Key Evaluation Criteria

When evaluating a flare gas meter, engineers must confirm several parameters to ensure long-term reliability:

Dynamic Range (Turndown Ratio): The Flowsic100 Flare offers a turndown ratio of up to 4000:1. This allows for the measurement of small leaks through valves during normal operation while still capturing the massive flows during a plant trip.

Resolution at Low Flow: In many regions, the ability to detect low-level "purge gas" flow is critical for environmental compliance. The system can resolve velocities as low as 0.03 m/s (approx. 0.1 ft/s).

Pressure and Temperature Ratings: Flare headers are generally low pressure but can experience high temperatures. Standard transducers are rated for temperatures up to 280°C (536°F), with specialized versions available for cryogenic or higher-temperature applications.

Installation Best Practices for Flare Systems

The accuracy of any ultrasonic flow meter is heavily dependent on the flow profile within the pipe. For the Flowsic100 Flare to perform within its specified uncertainty limits, several installation considerations must be addressed.

Straight Pipe Runs

To ensure a fully developed laminar or stable turbulent flow profile, the meter requires a certain length of straight pipe upstream and downstream of the measurement point.

Upstream: A minimum of 20 pipe diameters (20D) is recommended after a single elbow. If there are multiple elbows in different planes or a pressure reduction valve, longer runs may be required.

Downstream: A minimum of 10 pipe diameters (10D) is typically sufficient.

If these distances cannot be met, the measurement uncertainty will increase. In some cases, a dual-path configuration can be used to mathematically compensate for asymmetrical flow profiles caused by insufficient straight runs.

Transducer Mounting and Alignment

The transducers are typically installed at a 45-degree or 60-degree angle relative to the pipe axis. Precise alignment is critical; if the transducers are not pointed exactly at each other, the signal strength will drop significantly, especially at high gas velocities where the "beam blowing" effect occurs. Beam blowing happens when the gas flow is so fast that it physically pushes the ultrasonic pulse downstream, causing it to miss the receiving transducer.

Retraction Mechanisms

Because flare systems are critical safety components, they cannot be easily shut down for maintenance. The Flowsic100 Flare is often installed with ball valves and retraction tools (hot-tapping). This allows technicians to remove, clean, or replace transducers while the flare header is still in operation, ensuring continuous compliance and safety.

Operational Limitations and Environmental Factors

While ultrasonic technology is highly versatile, it is not without limitations. Engineers should be aware of the following factors that can impact the performance of the Flowsic100 Flare:

1. Liquid Entrainment: While the system can handle some moisture, heavy liquid slugging or thick coats of oil/condensate on the transducer faces will block the ultrasonic signal. In such cases, the use of transducers with a self-cleaning design or periodic purging is necessary.

2. Acoustic Noise: High-frequency noise from nearby control valves or pressure-reducing stations can interfere with the ultrasonic signal. This is known as "acoustic interference." The Flowsic100 Flare uses advanced digital signal processing (DSP) to filter out this noise, but physical distance from noise sources remains the best practice.

3. Solid Particles: High concentrations of soot or scale can cause signal scattering. While less common in clean gas flares, this is a consideration in older systems or those processing heavy crudes.

Integrating Flow and Level Measurement for Process Safety

In a comprehensive industrial automation strategy, flow measurement is rarely an isolated data point. For instance, in a refinery's tank farm or processing unit, flow data from the flare system is often cross-referenced with level measurement data from storage vessels and separators.

If a high-level switch or a radar level transmitter on a separator indicates a rapid rise in liquid level, and the Flowsic100 Flare simultaneously detects a spike in gas flow, the control system can identify a potential overfill or gas-blow-by event. For engineers looking to optimize these integrated systems, you can Review product options and application support to see how various level technologies complement flow monitoring in safety-instrumented systems (SIS).

Welk provides a range of level measurement instruments, such as radar level meters and ultrasonic level sensors, which are frequently used in conjunction with flare systems to monitor knockout drums (KOD). The knockout drum is a critical vessel that removes liquids from the gas stream before it reaches the flare tip. Monitoring the liquid level in the KOD is essential to prevent liquid carryover into the flare, which can cause "burning rain" or mechanical damage to the flare tip.

Frequently Asked Questions (FAQs)

How often does the Flowsic100 Flare require calibration?

Ultrasonic flow meters are inherently stable because they have no moving parts and do not suffer from mechanical wear. Most regulatory bodies require a "zero-point check" or an electronic verification annually. A full wet calibration in a lab is rarely required unless the physical geometry of the pipe changes or the transducers are replaced with a different model.

Can it measure 100% Hydrogen flow?

Yes. Hydrogen has a very high speed of sound compared to hydrocarbons. The Flowsic100 Flare electronics are designed to handle the wide range of transit times associated with hydrogen-rich streams, which are increasingly common in "Green Hydrogen" projects and traditional refinery hydrotreater flares.

What is the impact of CO2 on the measurement?

Carbon dioxide is a strong absorber of ultrasonic energy. If the flare gas contains more than 15-20% CO2, standard ultrasonic meters may lose signal. The Flowsic100 Flare uses high-power transducers and specific frequencies to overcome this attenuation, making it suitable for Carbon Capture and Storage (CCS) applications and high-CO2 gas fields.

Is the system suitable for SIL-rated loops?

Yes, the Flowsic100 Flare is available in versions certified for use in Functional Safety systems up to SIL 2 (Safety Integrity Level 2). This is vital for plants where flare flow data is used as a trigger for emergency shutdown procedures.

Summary of Evaluation for Project Teams

Before proceeding with the procurement of a Flowsic100 Flare system, project teams should confirm the following technical details:

Gas Composition Range: Provide the minimum and maximum expected molecular weights.

Pipe Material and Wall Thickness: Ultrasonic signals must pass through the mounting nozzles; knowing the pipe schedule is essential for correct transducer selection.

Area Classification: Ensure the electronics and transducers meet the local ATEX, IECEx, or NEC requirements for explosive atmospheres (Zone 1 or Zone 2).

Maintenance Access: Determine if hot-tap valves are required for online maintenance to avoid waiting for the next plant turnaround.

By addressing these factors and understanding the underlying ultrasonic principles, engineers can ensure that their flare gas measurement system provides the accuracy and reliability required for both environmental compliance and operational safety.